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Switching impacts of the output gap on inflation: Evidence from Canada, the UK and the US

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ABSTRACT

This paper examines the way in which output gap influences quarterly inflation during the period 1970q1–2013q1 in Canada, the UK and the US by adopting a Markov regime-switching model. In addition to the regime-dependent effects of the output gap, this study controls for the regime-invariant influences arising from changes in wages, oil prices and the nominal effective exchange rate. An interesting finding of this paper relates to the positive but varying impact of the output gap on inflation. Two significantly different regimes are identified whereby the probability of switching to regime 2 (represented by a relatively high output gap coefficient) peaks markedly and consistently across all three countries only when quarterly changes in inflation become noticeably large and volatile. The cross-country results provide compelling evidence that the coefficient assigned to the output gap rises significantly when the economy experiences sizable perturbations.

1. Introduction

Inflation plays a very important role in all financial and investment decisions. The aim of this paper is to examine the extent to which output gap influences inflation. A persistent positive output gap can be inflationary due to the excess demand pressure in an overheated economy which in turn may require a contractionary monetary policy. On the other hand, an expansionary monetary policy can be well justified when a looming recession or a slack economy precipitates consecutive and large negative output gaps. Assenmacher-Wesche and Gerlach (2008, p.411) examine inflation in Switzerland with two frequency bands during the period 1970–2005. Their study, inter alia, reveals an interesting finding that "inflation is Granger caused by monetary factors at low frequencies, defined as those corresponding to periodicities of more than 4 years, but is Granger caused by the output gap at high frequencies". Macroeconomists and policy advisors are also interested in the way in which the output gap influences inflation over time. Nelson (2009) in his comprehensive study compares the contrasting views of both the old and modern doctrines in relation to the asymmetric impacts of positive and negative changes in the output gap on inflation. For instance, the old doctrine posits that although positive output gaps are inflationary, a meagre economic slack may not necessarily exert significant disinflationary pressure on the economy. However, the proponents of the modern doctrine (mainly in the post 1979 era) argue that inflation "is sensitive to both positive and negative output gaps" (Nelson, 2009, F335).

There is an emerging consensus among macroeconomists that the excess demand (as proxied by the output gap) can affect inflation in the short run in an asymmetric manner. Some studies provide convincing evidence that rising output gaps can be more inflationary than falling output gaps are disinflationary (Clark, Laxton, & Rose, 2001; Clements & Sensier, 2003; Laxton, Meredith, & Rose, 1995; Laxton, Rose, & Tambakis, 1999). For example, based on a convex Phillips curve Clark et al. (2001, p.62) find that during 1964Q1–1995Q3 in the US "positive shocks to demand raise[d] inflation to a greater extent than negative shocks of the same

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magnitude lower[ed] it. This property implies that early action to counteract emerging inflation pressures can reduce the need to take stronger action later." In the literature a faster response to the negative output gap than other times is referred to as a recession avoidance preference by the Fed. Such different behaviour causes interest rate realizations being in the lower tail of the conditional distribution (Cukierman & Muscatelli, 2008).

Surico (2007) found that the relationship between inflation and output were asymmetric only before 1979. Milas (2009) studied the regime switching behaviour of the UK inflation between 'low' and 'high' rates of money growth. His results support the view that in the post inflation targeting era (1992Q4–2007Q1) "money matters for inflation, but only via the output gap channel" (Milas, 2009, p.180). Utilising a convex Phillips curve, Boinet and Martin (2010, p.986) find "that inflation becomes highly sensitive to the output gap as output rises above equilibrium but that inflation and output become increasingly disconnected as output falls below equilibrium". Clements and Sensier (2003) and Nelson (2005) have found that the effects of positive and negative changes in the output gap on inflation are not necessarily symmetric.

A number of studies have also examined the permanent trade-off between the variance of inflation and the variance of the output gap referred to as the "second order Phillips curve" (Taylor, 1979). Unlike Lee (2002) who found a negative relationship between these two variances, Friedman (2006) reasoned that the correlation between US output and inflation variability is indeed positive and very high (i.e. 0.81).

As can be seen from the above concise review of literature, the debate over the asymmetric and/or non-linear interplay between inflation and output gap has become particularly fervent in the last decade. From a slightly different angle and by employing a different econometric framework, the objective of this paper is to shed some new light on the output gap and inflation nexus using a Markov switching model. This study finds robust and consistent cross-country evidence that the output gap has more influence on inflation when inflation exhibits large and erratic variations. This paper thus contributes to a better understanding of the complex nature of the output gap–inflation nexus with tangible policy implications for the conduct of monetary policy.

The rest of this paper is structured as follows: Section 2 provides a brief discussion of the Markov switching methodology to capture the regime-dependent effects of the output gap on inflation over time. Section 3 presents the descriptive statistic and the unit-root test results during the sample period (1970q1–2013q1). Section 4 discusses the empirical results and policy implications of the study. Section 5 offers some concluding remarks.

2. Capturing switching impacts of the output gap on inflation

Many previous studies considered output gap as an important factor capturing demand pressure (Calvo, 1983; Gerlach & Svensson, 2003; Gerlach-Kristen, 2009; Mehra, 2004; Nelson, 2009; Roberts, 1995). For example, Nelson (2009) found that in the pre-1979 era while positive output gaps were inflationary, a certain amount of economic slack was not considered to be disinflationary. However in the post 1979 era, inflation "is sensitive to both positive and negative output gaps" (Nelson, 2009, F335). Boinet and Martin (2010, p.986) argue "that inflation becomes highly sensitive to the output gap as output rises above equilibrium but that inflation and output become increasingly disconnected as output falls below equilibrium". In relation to other factors affecting inflation, Delatte and López-Villavicencio (2012) analysed the asymmetric impacts of the exchange rate on prices in the short- and long-run in Germany, Japan, UK and US. They considered the unit labour cost and the price of oil as two other key determinants of inflation. Giannellis and Koukouritakis (2013) have also found that the impacts of the exchange rate variations on inflation are non-linear in a number of Latin American countries. Similar results were obtained by Naifar and Al Dohaiman (2013) concerning the non-linear effects of crude oil prices on inflation in the context of Gulf Cooperation Council countries. In this paper the following regime switching model is utilised to test whether the responsiveness of inflation to output gap exhibit any discernible behavioural difference in varying states (regimes):

$$\begin{cases} Q_t = f[\ \dot{P}_t(m), \sigma(m)\varepsilon_t] \\ \dot{P}_t(m) = \beta(m)GAP_t + Z_t'\gamma \\ Z_t'\gamma = \sum_{j=0}^{q=5}\mu_j\ \dot{W}_{t-j} + \sum_{j=0}^{q=5}\eta_j\ \dot{E}_{t-j} + \sum_{j=0}^{q=5}\lambda_j\ \dot{O}_{t-j} + \sum_{j=1}^{q=5}\theta_j\pi_{t-j} \end{cases} \tag{1}$$

where $\dot{P}$ = inflation rate, $\dot{W}_t$ = wage growth, $\dot{E}_t$ = growth of the nominal effective exchange rate, and $\dot{O}_t$ = growth of the price oil. Quarterly growth rates for these four variables are computed using log differences. The output gap is defined as the percentage deviation of the actual output (real GDP or Y_t) from the potential output: $GAP_t = (Y_t - Y_t^p)/Y_t^p$. For a general discussion of the models in which both regime switching and non-switching coefficients are allowed see Hamilton (1996) and Frühwirth-Schnatter (2006). Assuming two possible regimes (or $m = 1, 2$), in the above system of equations the regime invariant coefficients associated with the vector Z_t are indicated by γ and the two regime switching coefficients $\beta(m)$ for GAP_t are defined as:

$$\beta(m) = \begin{cases} \beta^L GAP_t & \text{Low coefficient regime if } S_t = 1 \\ \beta^H GAP_t & \text{High coefficient regime if } S_t = 2 \end{cases} \tag{2}$$

It is expected that $\sum_{j=0}^{q=5}\mu_j > 0$ and $\sum_{j=0}^{q=5}\lambda_j > 0$ since inflation will increase as a result of rising wages and oil prices. In addition, the appreciation of domestic currency versus other (trade weighted) currencies can bring about falling prices of the imported goods and